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Coalition for Networked Information

**An Introduction
&
Program Plan 2011-2012**

CNI STEERING COMMITTEE, 2011-2012

Daniel Cohen, George Mason University, at large member, 2011-2012
Jeffrey Horrell, Dartmouth College, representing ARL, 2010-2013
Charles B. Lowry, Association of Research Libraries, *ex officio* member
Clifford A. Lynch, Coalition for Networked Information, *ex officio* member
Kathryn Joan Monday, University of Richmond, representing EDUCAUSE, 2011-2014
Diana G. Oblinger, EDUCAUSE, *ex officio* member
Pattie Orr, Baylor University, representing EDUCAUSE, 2009-2012
Carrie E. Regenstein, Carnegie Mellon University, representing EDUCAUSE, 2010-2013
Sherrie Schmidt, Arizona State University, representing ARL, 2009-2012
Tyler O. Walters, Virginia Polytechnic Institute and State University, representing ARL, 2011-2014
Donald J. Waters, The Andrew W. Mellon Foundation, at large member, 2011-2012

CALENDAR OF KEY MEETINGS

- ARL/CNI Forum: *21st-Century Collections & the Urgency of Collaborative Action*, Washington, DC – October 13-14, 2011
- 7th International Digital Curation Conference: *Public? Private? Personal? Navigating the Open Data Landscape*, Bristol, UK — December 5-7, 2011
- 2011 Fall Membership Meeting, Arlington, VA – December 12-13, 2011
- 2012 Spring Membership Meeting, Baltimore, MD – April 2-3, 2012
- Ninth International JISC/CNI Conference – Summer 2012

CNI STAFF

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Coalition for Networked Information

An Introduction & Program Plan 2011-2012

Mission

The Coalition for Networked Information (CNI) is an organization to promote the transformative promise of networked information technology for the advancement of scholarly communication and the enrichment of intellectual productivity.

Background and Leadership

The Coalition for Networked Information (CNI), a joint initiative of the Association of Research Libraries (ARL) and EDUCAUSE, promotes the use of digital information technology to advance scholarship and education. In establishing the Coalition under the leadership of founding Executive Director Paul Evan Peters, these sponsor organizations recognized the need to broaden the community's thinking beyond issues of network connectivity and bandwidth to encompass digital content and advanced applications to create, share, disseminate, and analyze such content in the service of research and education. Reaping the benefits of the Internet for scholarship, research, and education demanded—and continues to demand—new partnerships, new institutional roles, and new technologies and infrastructure. CNI seeks to advance these collaborations, to explore these new roles, and to catalyze the development and deployment of the necessary technology base.

Since its founding in 1990, CNI has addressed a broad and diverse array of issues related to the development and use of digital information in research and education environments. As the premier organization fostering connections and collaboration between library and information technology communities, we represent the interests of a wide range of member organizations from higher education, publishing, networking and telecommunications, information technology, government agencies, foundations, museums, libraries, and library organizations.

CNI is supported entirely from dues paid by its over 200 member institutions. Membership in the Coalition is open to all organizations—both for-profit and not-for-profit—that share CNI's commitment to furthering the development of digital information in the networked environment. We view our members as partners in advancing the Coalition's mission. Fall and spring membership meetings are CNI's flagship events, bringing together hundreds of representatives for a comprehensive update on critical issues.

CNI's program is guided by a Steering Committee to which sponsor organizations ARL and EDUCAUSE each appoint three representatives drawn from their member leadership; the current roster of Steering Committee members appears on the inside front cover of the printed *Program Plan*. Three "at large" representatives on the Steering Committee contribute additional perspectives. The chief executives of ARL, EDUCAUSE, and CNI serve as *ex officio* members of the committee.

CNI Executive Director Clifford Lynch has led the organization since 1997. Joan Lippincott, CNI's Associate Executive Director, has served since fall 1990. For more information about the Coalition's history and contributions, see the CNI Web site at www.cni.org.

Program Themes

CNI's work is structured around three central themes that we believe are the essential foundations of the vision of advancing scholarship and intellectual productivity:

- **Developing and Managing Networked Information Content**

The Coalition has played a central role in ensuring that the network richly engages the needs of scholarship, teaching and learning. We bring together many diverse groups that create and manage content, and work with these communities to advance the deployment and stewardship of networked information resources. Changes in scholarly practices (particularly those shorthanded

by “e-science” or “e-research”) require a close and continuing examination of information creation, aggregation, exchange, reuse, and preservation throughout the research and education community and society broadly; these developments, and the evolving roles of higher education and cultural memory institutions in facilitating and supporting them are a central part of the CNI agenda. Working within these contexts and others, CNI furthers the development of economic, policy, social and legal frameworks to sustain the creation and management of digital information and facilitate its access.

• **Transforming Organizations, Professions, and Individuals**

The pervasiveness of ubiquitously accessible digital information is transforming institutions, professions, and the practices of learning and scholarship. CNI focuses on the unprecedented need for collaboration among libraries, information technology and instructional technology groups, faculty, museums, archives, university presses, and other units in order to achieve success in this environment. In addition, we promote new alliances and partnerships with publishers, information technology and network service providers, scholarly societies, government, and other sectors. Organizations must understand their constituencies and adapt their services and facilities to current needs; they must develop and share new strategies, policies, and best practices. Professions need to develop new competencies and enter into new dialogues that cross traditional disciplinary boundaries. CNI seeks to facilitate these collaborations and dialogues and to help professions and institutions work together in program strategy formulation.

• **Building Technology, Standards, and Infrastructure**

The networked information environment relies on the development and deployment of standards and infrastructure components in order to enable the creation, discovery, use, and management of digital information on the Internet. The ability to use collections of resources in a unified, consistent fashion is essential and requires a continuing focus on interoperability of services. At the same time, promising new technologies need to be explored, assessed and tested, and sometimes adapted to the needs of the CNI community. No one institution acting alone can build the needed infrastructure or explore the full range of new technologies as they become available; it requires a coordinated, community-wide effort that also reaches out to other communities, such as the world of e-research. CNI seeks to highlight links between technology and policies at all levels, to offer a context for collaborative experiments and testbeds, and to serve as a focal point for sharing knowledge about new technologies.

The specific program initiatives that further CNI’s themes evolve from year to year. The initiatives and strategies planned for 2011-2012 are described in the *Program Plan* portion of this publication; most build upon and continue efforts already underway. Many of the initiatives seek to make strategic progress relevant to more than one theme.

It is important to recognize that the digital information environment is still changing rapidly. CNI is continually adapting its activities in response to new developments and opportunities. Indeed, CNI believes agility is essential in the current environment and invites a continuous dialogue with its members on the need for additional program initiatives. Because of this, the 2011-2012 *Program Plan* should be viewed as a snapshot of our thinking about priorities and opportunities as of late 2011 that will inevitably develop further during the coming year.

Policy and Consultative Activities

CNI acts as an important and respected voice on behalf of our community in a wide range of national and international policy venues. This is accomplished through our participation in the ongoing scholarly dialogue; through collaboration with key funding agencies, such as the National Science Foundation (NSF), the Institute of Museum and Library Services, the National Endowment for the Humanities, the Andrew W. Mellon Foundation, and the Joint Information Systems Committee (JISC); through work on advisory groups of organizations such as Ithaka, OCLC, the American Library Association (ALA), and Microsoft Research; through service on numerous visiting and advisory committees for our member institutions; through contributions to standards efforts and standards organizations such as the National Information Standards Organization (NISO); and through participation in organizations such as the Internet Society.

Of particular note in this area are our recent contributions to the Library of Congress's National Digital Information Infrastructure and Preservation Program (NDIIP), to various studies and programs conducted by the U.S. National Research Council, particularly in conjunction with the Board on Research Data and Information (BRDI), to the Campus Bridging Task Force of the NSF Advisory Committee on Cyberinfrastructure, to the Blue Ribbon Task Force on Sustainable Digital Preservation and Access, the NSF-funded study on software sustainability, and the ALA Working Group on Libraries and Digital Content.

As a contributor and participant within a complex ecosystem of organizations that share common interests, CNI works with Internet2 on advanced networking applications and standards; with the Council on Library and Information Resources (CLIR) on scholarly communication, cyberinfrastructure, and preservation issues; with the New Media Consortium on the exploration and use of new media and new technologies in higher education; with the Learning Spaces Collaboratory on development of principles for technology-enabled spaces that enhance learning; and with ALA on policy and professional development activities. Our contributions extend to the programs of our sponsor organizations, ARL and EDUCAUSE, particularly to the EDUCAUSE Learning Initiative (ELI) and the Advanced Core Technologies Initiative (ACTI).

In addition to specific initiatives to address CNI's overarching program themes, the Coalition actively conducts an ongoing program of collaboration and advocacy to advance the development of digital information and its role in transforming organizations and scholarly activities. To this end, CNI works with scholarly societies, government agencies, publishers, and others.

On an international level, we collaborate with other organizations concerned with networked information, including the UK Office for Library Networking (UKOLN), the Digital Curation Centre (DCC), and the Joint Information Systems Committee (JISC) in the UK, the German Initiative for Networked Information (DINI), the German Research Foundation (DFG), Denmark's Electronic Research Library (DEFF), the SURF Foundation (the Dutch higher education and research partnership organization for network services and information and communications technology), and the Confederation of Open Access Repositories (COAR).

CNI works to provide our community with frameworks for understanding key networked information issues so that institutions can develop strategies to address these issues on the local, regional, or national level. We write white papers, reports, and articles, we present talks at conferences, and we make institutional visits that may involve meetings with campus leaders and presentations at public events and seminars.

CNI alerts its community to our organizational activities, significant new publications, and important developments in the field via the CNI Web site, the CNI-ANNOUNCE e-mail list, and the CNI News RSS. Information about CNI's activities is also available through Twitter (twitter.com/cni_org), which serves as a complement to other communication channels. Through the free podcast series *CNI Conversations*, we provide reports and commentary on current topics (www.cni.org/cni-conversations). We also make video of selected sessions from our membership meetings publicly available from CNI's YouTube and Vimeo channels (www.youtube.com/cnivideo, vimeo.com/channels/cni).

Meetings

The Coalition's semiannual membership meetings, scheduled for December 12-13, 2011, in Arlington, VA, and April 2-3, 2012, in Baltimore, MD, highlight activities related to CNI's program themes, focus attention on significant new thinking and technology developments, and provide opportunities for members to showcase and discuss a wide range of emerging issues and developments in networked information. Some participants have developed knowledge communities within CNI and use the meetings as an opportunity to share ideas on a particular aspect of networked information and incubate new initiatives. Each member organization is invited to send two delegates, typically a senior information technologist and a senior librarian. Meeting participants are introduced to new developments that may reshape institutional plans in a forum that encourages collaborations and dialogues with others who share common interests. CNI has a long history of being the first to offer discussion of major networked information developments, including Mosaic, the National Science Foundation's (NSF) Digital Libraries Program, the Google Books Scanning program, and NSF's DataNet awards.

CNI regularly co-sponsors a conference in partnership with JISC and UKOLN as part of our ongoing collaboration with these programs. The last conference was held in Edinburgh, Scotland on July 1-2, 2010; we anticipate that the next meeting will be held in the summer of 2012.

CNI occasionally convenes invitational or public workshops to advance specific elements of its program plan. We also serve as co-sponsor for other meetings relevant to the CNI agenda. This year these events include the ARL and CNI co-sponsored forum "21st-Century Collections and the Urgency of Collaborative Action," on October 13-14, 2011, in Washington, DC, and the 7th International Digital Curation Conference, "Public? Private? Personal? Navigating the Open Data Landscape," December 5-7, 2011, in Bristol, UK.

In addition, CNI was a co-sponsor of the Theory & Practice of Digital Libraries Conference (formerly ECDL), in Berlin, Germany, on September 26-28, 2011, and will serve as a cooperating organization for the Personal Digital Archiving Conference, to be held February 23-24, 2012, the Joint Conference on Digital Libraries, scheduled for June 10-14, 2012, in Washington, DC, the IS&T Archiving Conference on June 12-15, 2012, in Copenhagen, Denmark, the Open Repositories 2012 meeting in Edinburgh on July 9-13, 2012, and the Fourth International M-Libraries Conference in Milton Keynes, UK on September 24-26, 2012.

PROGRAM PLAN 2011-2012

Developing and Managing Networked Information Content

The Coalition has broad interests across all forms of digital content that can be used to support research and education. We provide a forum for information on leading projects in this arena, including a showcase at CNI membership meetings for innovative faculty projects from our member institutions. In addition, we track developments and promote strategies for the creation of digital collections, digital libraries, and federated services in support of digital content. Further, because digital content cannot be divorced from the processes of teaching, learning, and scholarship that both create and rely upon that content, CNI is deeply involved in issues related to changing practices of scholarship, the restructuring of scholarly publishing (including changes in processes like peer review) and the broader transformation of scholarly communication, and innovation in teaching and learning. Through our membership meetings, specialized conferences and workshops, collaborative initiatives with other organizations, and publications, we provide leadership on digital content policy and new directions in scholarly communication.

• Institutional and Disciplinary Implications of E-Research

The Coalition has long been engaged in efforts to chart, understand, and facilitate the transformation of scholarly practice through the use of digital content and advanced information technology as part of its fundamental mission. In the sciences and engineering, CNI has been heavily involved in helping the higher education and library communities understand and frame emerging issues in cyberinfrastructure and e-science, with a primary focus on data sharing and data curation issues. In the arts and humanities, CNI, in collaboration with partners such as the J. Paul Getty Trust, the American Council of Learned Societies (ACLS), the National Research Council (NRC) and the Association of Research Libraries (ARL), has a long record of leadership in computing and the humanities and outreach to build collaborations with the museum and archives communities.

In the 2011-2012 program year, CNI will continue to engage e-research developments both in the sciences and the humanities. There is new urgency in this area in light of the requirements for data management and data sharing plans that the US National Science Foundation (NSF) and a number of other US federal agencies have put in place as part of grant proposal submissions, joining the already-established similar National Institutes of Health requirements. Faculty investigators need guidance from both their funders and their home institutions on how best to meet these requirements, and they will be demanding new services at both disciplinary and institutional levels. The NSF has launched major programs addressing data curation (the DataNet initiative, and also the Community-based Data Interoperability Networks program), and we will be highlighting developments from these programs in our membership meetings. Following on the report of the ACLS Commission on Cyberinfrastructure for the Humanities & Social Sciences, CNI is participating in ongoing discussions about how to frame strategies for effective investment in digital humanities. We will feature work of projects such as those supported through the National Endowment for the Humanities Office of Digital Humanities, the Institute of Museum and Library Services (IMLS), The Andrew W. Mellon Foundation, and the multi-sponsor, international Digging into Data initiative, emphasizing computationally intensive research enabled by a robust infrastructure.

CNI is concerned with questions about availability of data related to scholarly work, and has been engaged in a number of discussions around open access, open science, and open data as they relate to this question, as well as discussions about disciplinary norms for data sharing. We will

also continue to explore and document the ways in which data and computationally intensive scholarship are altering the nature of scholarly communication; the issues here include the legal and technical barriers to large-scale text and data mining; appropriate organizational, policy and technical strategies for linking articles and underlying data; and ways to construct scholarly works that are amenable to various combinations of human and machine use. Critical new developments here include the emergence of virtual research environments as arenas for the interoperation of data and tools from multiple sources, and the need to better understand the complex architectural questions about the relationships among repositories, operational storage systems, e-research workflows, high performance network connectivity and powerful computational resources.

Connecting our work in e-research directly to our program focus on institutional content resources, CNI will continue to examine institutional policy and planning implications of campus cyberinfrastructure initiatives in both the sciences and humanities, and consider how these can complement national or international cyberinfrastructure investments and strategies at disciplinary and cross-disciplinary levels.

• **Digital Preservation**

Closely related to, and supporting the programmatic focus on stewardship of institutional resources is the Coalition's continuing work on preservation of a wide variety of digital content. This is a central issue not only in the shift to network-based scholarly communication, but also in ensuring the continuity of the broad cultural and intellectual record in the digital age and the continued availability of evidence to support future scholarly inquiry. The issues here are not simply technical, but represent a fundamental social and public policy challenge with wide-reaching implications; we are particularly interested in trying to define and characterize the ever growing range of materials that should constitute parts of our cultural and intellectual record, including new areas such as social media in the broadest sense. CNI works closely with ARL, the Council on Library and Information Resources (CLIR), The Andrew W. Mellon Foundation, the Library of Congress, the US National Science Foundation (NSF), Ithaka, the UK Digital Curation Centre (DCC), and OCLC on the full range of technical, economic, and strategy issues surrounding digital preservation.

We will co-sponsor and co-chair the DCC's 7th International Digital Curation Conference, which will take place in Bristol, UK on December 5-7, 2011, and co-sponsor the Imaging Science and Technology (IS&T) Archiving meeting, scheduled for June 12-15, 2012 in Copenhagen, Denmark. Digital preservation progress will continue to receive extensive coverage at CNI membership meetings.

The wide-scale adoption of networked information services and the shift to digital content raises a set of new questions about risk management and business continuity planning for libraries and higher education institutions. CNI continues to track these risk management issues, exploring developments and experiences with so-called "cloud" storage systems and their implications for robust storage and digital preservation, as well as some of the thinking emerging from the exascale computing and massive storage communities on the development of resilient systems, and the ways in which these ideas can be applied to very large scale digital preservation. We'll explore some of these topics in our Fall 2011 Executive Roundtable.

Another area in which CNI has maintained a strong interest is in the changing nature of personal information storage and personal archiving, and the social and scholarly implications of these developments. A specific case in point is the institutional response to the acquisition of large, personal digital archives from scholars and researchers, as well as the personal archives of prominent intellectual, artistic, literary, political and similar figures. CNI will be heavily involved

again in the third Personal Digital Archiving Conference, which will be hosted at the Internet Archive in San Francisco, February 23-24, 2012. The digital records of organizations are also poorly explored; a particular area of CNI interest is the changing nature of the academic record caused by the deployment of learning management systems, institutional repositories (IRs), large-scale lecture and event capture, and long-lived, collaborative resources jointly developed by faculty and students; this will have lasting policy implications for special collections and institutional archives.

• **Institutional Content Resources and Repositories**

A centerpiece of CNI's work on networked information is built around the broad theme of the stewardship of institutional content resources—materials created by members of the institutional community, or that document the work, processes or intellectual and cultural life of an institution. The practice of such stewardship, which includes management, preservation, and access, is a central role for higher education and cultural memory organizations in the digital age. Our work here has two major components. One is to advance and structure the wealth of new digital content. The program includes our continuing efforts to understand and highlight experiments in the creation of new types of scholarly works for the digital medium, such as successors to the scholarly print monograph or the development of electronic theses and dissertations; the disposition of materials collected through lecture capture systems; the implications of mass digitization of materials to support scholarship; and the availability of digital representations for existing collections of physical materials held in libraries, archives, museums, and audio/visual and public broadcasting groups. The second major effort focuses on approaches to managing the wealth of new content through the development of strategies such as the deployment of IRs. Here CNI is addressing the full range of issues from policy and strategic planning through system architecture and standards for the management of complex digital objects.

We will continue to explore ways in which institutional strategies and systems need to connect to national and disciplinary-level data management and curation activities (such as those developing through the e-research initiatives described above), and some of the inter-institutional issues that arise from large-scale research collaborations and virtual organizations.

A continuing priority is a focused ongoing re-examination and re-assessment of IR services. The concept of the IR is almost 10 years old; CNI was deeply involved in the initial conceptualization of these services and the development of implementation strategies for them. Platform alternatives have multiplied and matured, and understandings about costs, as well as barriers to successful deployment, have become much clearer. Indeed, we are seeing significantly different deployment trajectories in different nations, particularly in the context of subject repositories and other disciplinary data management frameworks, and these are leading to new policy issues and requirements for various kinds of interoperability standards.

We are particularly interested in ways in which the impact of IRs might be measured, and their interactions with virtual organizations, faculty movement from one institution to another, and with stewardship of scholarly work associated with faculty retirements. We hope to begin to move forward on some work specifically focused on this area late in 2011 and extending into upcoming program years.

Transforming Organizations, Professions, and Individuals

The pervasive nature of digital content and networks has led to transformations in the way the research and education community does its work. In this program area, we focus on the impact of changing

technologies, new modes of communication and content creation, and the pervasiveness of digital content on organizations, including the changing nature of teaching and learning, the need for new services and skills in the professions, and the pressure on physical facilities to accommodate changing needs of user communities. CNI has a longstanding commitment to highlighting and advancing organizational initiatives that facilitate collaborations across institutional units and professional cultures, with particular emphasis on collaboration between librarians and information technologists. We have also tried to extend the core library-information technology collaboration to encompass instructional technologists, faculty, publishers, electronic records managers, archivists, research managers and others. Our work on organizational and institutional issues includes a focus on evaluation and assessment strategies, recognizing the continuing need to understand the effects and contributions of advanced information technology and digital content.

• **Today's Learners and Digital Content**

A cross-cutting theme informing our work on teaching and learning in recent years has been understanding the increasing population of students who have grown up with computer and information technologies. While these students are often described as very different from older generations in their use of technology, many of the characteristics of their uses of information and technology (such as actively exploring and developing their own learning environments, working in groups, and producing, not just consuming, digital resources) have also been incorporated into the lives of most adult professionals. We help institutions understand the need to reconfigure some of their services and their physical and virtual spaces to reflect the ways in which our students work with technology and information today.

As both students and faculty increasingly produce new digital information, sometimes incorporating parts of others' work, and often in complex social software contexts, they have a pressing need to understand a wide range of issues including intellectual property, privacy, preservation, format standards, and metadata creation. A variety of literacies—information, technology, and visual—are converging as students, faculty, and others produce innovative digital content.

• **Implications of Mobile Technologies**

The faculty, staff, and students in our institutions bring a variety of mobile devices to campus and also use mobile devices to access campus information and services when they are at home, commuting, at work, or abroad. They bring increasing expectations for seamless use of a variety of devices to access all types of services and information. Surveys of the general public and of academics show the increasing variety of mobile device ownership and the mounting popularity of these devices for many activities, including accessing schedule information, receiving security alerts, reading e-books, accessing e-journals or preprint collections, and participating in social networking activities. Many libraries participate in e-book programs and some loan a variety of devices, including tablet computers, portable audio players, video cameras, netbooks, and laptops. Some institutions are experimenting with the use of mobile devices in teaching and learning, and researchers use mobile devices for data collection and communication in the field. New applications involve sophisticated geo-tagged information and augmented reality, or the use of portable devices as distributed "sensors." Institutions are at varying stages of readiness in determining policies, services, and strategies for mobile devices. We will encourage institutions to develop cohesive strategies as they enter the arena of provision of content and services for mobile devices, and we will highlight campus strategies that incorporate services from a wide variety of institutional units, including libraries.

• **Spaces and Services that Support Technology-enhanced Research and Learning**

Our interest in learning or information commons continues its focus on aligning new services and new technologies in spaces that enhance the teaching and learning mission of the institution. More than comfortable, collaborative spaces, learning or information commons can promote the integration of content and technologies into student-produced work in a way that engages them in the academic enterprise. Our work also emphasizes how these spaces can provide mechanisms for a variety of professionals to collaborate to offer student-centered services. Librarians, instructional technologists, multi-media specialists, information technologists, and writing center staff are some of the partners who may work together to offer joint services in commons areas.

For several years, we have also been highlighting digital scholarship centers as an emerging area of interest in both research and college libraries. These centers provide a suite of spaces, high-end technologies, and in-depth consultation for faculty, graduate students, and upper-level undergraduates working on capstone projects. In this program year, we will continue to explore digital scholarship centers in the humanities and other disciplinary areas. We will encourage a better understanding of the rationale and mission for a center, suggestions for good practice, and models of services.

The assessment of learning spaces has garnered increasing attention, and we will be working with our partners to explore principles and practices in this area. We are working with the EDUCAUSE Learning Initiative's Seeking Evidence of Impact program to examine the link between learning and use of technology-enabled informal learning spaces such as libraries, learning commons, and media labs. We partner with the Learning Spaces Collaboratory (LSC), which is exploring the intersection of research and practice in the planning of 21st century learning spaces.

• **Executive Roundtable**

CNI's Executive Roundtable series assembles executive teams (usually the chief librarian and chief information technology officer) from about 10 institutions for a focused discussion on a topic of interest on the morning of the first day of each membership meeting. Launched in 2003, the Executive Roundtables build on the theme of collaboration between librarians and information technologists that has been at CNI's foundation. Past topics have included institutional repositories, campus open access policies, learning management system strategies, identity management, learning spaces, funding innovation, the university's role in the dissemination of research and scholarship, lecture and performance capture, and infrastructure to support research. The fall 2011 Executive Roundtable will focus on disaster planning and strategies that institutions are developing to address risk management, with a particular focus on information resources. The spring 2012 Roundtable is expected to focus on the growing diversity of platforms—smart phones, tablets, and more traditional computers—that students are bringing to campus, and institutional strategies for responding to this diversity.

Building Technology, Standards, and Infrastructure

CNI continues to be actively engaged in key areas of standards and infrastructure development. The Coalition is particularly concerned with facilitating the difficult and delicate transition of standards and technologies into operational infrastructure for the research, higher education and library communities. In addition to the specific program initiatives described here, CNI participates in and tracks a wide range of developments in areas as diverse as identifiers, digital books, metadata

standards, distributed and federated network services, harvesting technologies, recommender systems, and personalization technologies. As we look at an evolving landscape that includes commercial Web search engines, traditional library automation tools such as online catalogs, stand-alone abstracting and indexing databases, systems deployed by scholarly publishers, museums, and other content providers, and learning management systems, the Coalition is concerned with architectural and standards frameworks that can facilitate integration and interoperation. This perspective has motivated much of our work over the last few years on cyberinfrastructure, IRs, the various components of the Open Archives Initiative (including the protocol for metadata harvesting, the object reuse and exchange protocol, and, most recently, the Open Annotation work), and learning management systems. Currently, we see a number of trends that we believe will drive a renewed focus on standards and infrastructure, including the proliferation of mobile devices (smart phones, tablets, e-book readers), the move towards data resources as part of the infrastructure (changes in identity, bibliographic control, etc.), and the move towards cross-institutional systems (Web-scale discovery and resource sharing, cloud computing, and distributed storage). Many of them couple technical issues with policy challenges in novel ways. We have been exploring the issues in these areas through articles and presentations, executive roundtables and other programming at our membership meetings, and participation in a range of committees and advisory boards.

• **Institutional Infrastructure to Support Research**

There is a renewed focus on campus infrastructure to support research programs. Developments include: policy, technical, and economic influences that are leading to a partial re-centralization of computing functions; radically new high performance network and distributed computing technologies; a rethinking of storage functionality and economics; requirements for long-term data management, curation and preservation; and growing faculty demands for informatics support services. An additional dimension of these needs involves information and technology intensive collaborations among groups at multiple campuses (sometimes characterized as collaboratories or virtual organizations) and virtual research environments that enable such collaborations. Complementing the organizationally oriented work on e-research already described, CNI is also concerned with the institutional and cross-institutional development of technical infrastructure, with a particular focus on large-scale storage and data management (discussed in more detail earlier), and on collaboration tools and environments. Of particular concern is the persistently difficult integration of investment in national level research infrastructure and campus-level investments and approaches; we participated in the recent NSF Task Force on Campus Bridging, and are advising a new NSF-funded effort on sustainability of infrastructural software, as well as working closely with efforts such as the EDUCAUSE Advanced Core Technology Initiative (ACTI) working groups on campus cyberinfrastructure and on data, and relevant work within the Common Solutions Group.

Authentication and authorization are now established as essential infrastructure components for network-based services and have become a particularly critical need as institutions increasingly rely on site license agreements with information providers, implement online and distance education initiatives, and form consortia for resource sharing or educational initiatives. They are an essential underpinning for data sharing and data reuse. The Coalition has been supporting partners such as Internet2, EDUCAUSE and InCommon in pursuing a program to define technology approaches, standards, best practices, and policy and business issues for such inter-organizational authentication and authorization infrastructures.

CNI takes a broad view of security, integrity, and access management issues as they relate to the management of licensed resources and the stewardship and preservation of digital content.

For example, federated identity management is becoming a key infrastructure component to support research using resources beyond a single campus. New technological capabilities— notably the ability for users to amass and maintain massive personal digital libraries which include large amounts of copyrighted material drawn from licensed databases—continue to raise complex questions with both technological and policy dimensions. CNI believes that we must continue to explore new behaviors and practices such as the building of workgroup or personal collections, or large-scale text and data mining that integrates published literature and public datasets with unreleased materials.

- **The Coming Convergence Of Identity Management, Biography, Bibliography and Social Discovery**

We will continue exploration of the potential future convergence, or at least linkage, between identities as established by campus-based identity management systems on one hand, and personal names as used in the context of scholarly communication, citation, and bibliographic control name authority on the other. Historically, these worlds have been almost completely separate and highly insular, but the emergence of sophisticated author rights retention strategies, institutional and disciplinary repositories, advanced bibliometrics and webmetrics, and directories and social discovery systems in academic settings, are clearly bringing them into closer alignment. Connections to public history, genealogy, and prosopography or large-scale biography are also fast emerging, essentially recognizing potential continuity between forward-looking infrastructure and historical documentation. Numerous systems and initiatives that are relevant to parts of this program, such as ORCID, VIVO, and new developments within Web of Science, Microsoft Academic Search, Google Scholar and other platforms are making this a very dynamic area.

RECENT PUBLICATIONS BY CNI STAFF

Selected Recent Publications by CNI Staff

- Lynch, Clifford A. "Imagining a University Press System to Support Scholarship in the Digital Age." *Journal of Electronic Publishing* (Fall 2010).
- Lippincott, Joan K. and Clifford A. Lynch. "ETDs and Graduate Education: Programs and Prospects." *Research Library Issues* 270 (June 2010): 6-15.
- Lippincott, Joan K. "A Mobile Future for Academic Libraries." *Reference Services Review* 38, no. 2 (2010): 205-213.
- Lippincott, Joan K. "Information Commons: Meeting Millennials' Needs." *Journal of Library Administration* 50, no. 1 (January 2010): 27-37.
- Lynch, Clifford A. "Jim Gray's Fourth Paradigm and the Construction of the Scientific Record." In *The Fourth Paradigm: Data-Intensive Scientific Discovery*, edited by Tony Hey, Stewart Tinsley, and Kirstin Tolle, 177-183. Redmond, WA: Microsoft Research, 2009.
- Lynch, Clifford A. "Special Collections at the Cusp of the Digital Age: A Credo." *Research Library Issues* 267 (December 2009): 4-10.
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Serving as Committee Members, CNI Staff Contributed to these Selected Recent Reports:

- National Science Foundation. *Final Report of the NSF Advisory Committee for Cyberinfrastructure Task Force on Campus Bridging*. March 2011.
- Laurence F. Johnson, Alan Levine, Rachel S. Smith, and Sonja Stone. *2011 Horizon Report*. Austin, TX: The New Media Consortium, 2011.
- OCLC Record Use Policy Council. *WorldCat Rights and Responsibilities for the OCLC Cooperative* approved by the OCLC Board of Trustees on June 14, 2010, effective August 1, 2010.
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- National Science Foundation Task Force on Cyberlearning. *Fostering Learning in the Networked World: The Cyberlearning Opportunity and Challenge, a 21st Century Agenda for the National Science Foundation*, June 2008.
- Library of Congress Working Group on the Future of Bibliographic Control. *On The Record: Report of the Library of Congress Working Group on the Future of Bibliographic Control*, January 2008.

Most publications, as well as selected presentations and interviews, are available online via <http://www.cni.org/publications>.

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FRONT (left to right):

Longest and Shortest Crease-B

By Sharol Nau

Folded book, 12.5" x 9" x 6", 2010

For this book-sculpture of several hundred pages, the shortest crease was obtained by folding the pages without separating them from the binding. Also the folding process began in the middle in an effort to achieve a symmetrical design.

Courtesy: Sharol Nau (whitecrow@snakedance.org)

Description is from the American Mathematical Society Mathematical Imagery

Web site (<http://www.ams.org/mathimagery/2011>) Mathematical Art Exhibition Gallery

Crystal III (background)

By Eric J. Heller

Looking top down into a 3D perfect crystal, both crystalline and quasi-crystalline elements are seen. For, if we look through a perfect 3D crystal at irrational angles, we see a quasi-crystalline (non-repeating but non-random space filling pattern) structure. The various "diophantine" solutions of number theory are seen as clear paths through the crystal.

Courtesy: Eric J. Heller, Harvard University

<http://www.ericjhelligallery.com/>

Barbershop III

By Eric J. Heller

Barbershop III is a sonogram (simultaneous time-frequency analysis) of a barbershop quartet, specifically a segment of Southern Roses as sung by the Gas House Gang, a particularly elegant barbershop group.

Courtesy: Eric J. Heller, Harvard University

<http://www.ericjhelligallery.com/>

Ecological Genomics of Reef Corals (Image 2)

Young sibling polyps of staghorn coral (*Acropora millepora*) three days after settlement. In a National Science Foundation-supported study, researchers found that the ability to fluoresce may influence whether or not the coral settle on the reef of their origin or disperse, and go elsewhere.

Date of Image: October 2006

Credit: Mikhail Matz, Joerg Wiedenmann

Courtesy: National Science Foundation

Image & description are from the National Science Foundation Multimedia Gallery (<http://www.nsf.gov/news/mmg/>)

BACK:

Hyperbolic Tiling I

By Vladimir Bulatov

Rapid prototyping sculpture, 200mm x 60mm x 60mm, 2010

"This is a visualization of a tiling of the hyperbolic space. The tiling is generated by reflections in the faces of Lambert cube (Coxeter polyhedron), which becomes the fundamental polyhedron of the symmetry group of the tiling. Only 4 out of 6 sides are used, which results in sub-tiling (subgroup) filling only part of the space.

It let us see the internal structure of the tiling. We use a cylinder model of the hyperbolic space—a 3D generalization of 2D band model. In this model the Poincare ball is stretched into infinite cylinder. Cylinder's axis becomes one of hyperbolic geodesics. The tiling is oriented to make one it's [sic] plane to be orthogonal to the cylinder's axis to have a feet to stand on. The cylinder's axis is close to the axis of a loxodromic transformation of the group, which gives the pieces its spiral twist. The sharp boundary of the piece corresponds to the limit set of the group. The limit set is fractal Jordan curve at the infinity of the hyperbolic space." —Vladimir Bulatov

Courtesy: Vladimir Bulatov (<http://bulatov.org>)

Description is from the American Mathematical Society Mathematical Imagery

Web site (<http://www.ams.org/mathimagery/>) 2011 Mathematical Art Exhibition Gallery

Caustic Sunset (background)

By Eric J. Heller

Caustics are places where things accumulate; in this case light is accumulating: the light intensity passing through two wavy layers of water was used to "color" the sky; here the darker shades represent more light, with the red highlights added. We often think of focal points as places where light gathers after passing through a lens, but more generally, for "random" lenses, there are many more interesting patterns to examine.

Courtesy: Eric J. Heller, Harvard University

<http://www.ericjhelligallery.com/>

*Descriptions are from image sources unless otherwise noted.



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